2-23)
$$\vec{E} = \frac{k}{\varepsilon_0}\frac{(b-a)}{r^2}\hat{r} \qquad r > b$$
$$= \frac{k}{\varepsilon_0}\left(\frac{1}{r} - \frac{a}{r^2}\right)\hat{r} \qquad a \le r \le b$$
$$= 0 \qquad r < a$$

$$V = -\int_\infty^r \vec{E}\cdot d\vec{l}$$

$$d\vec{l} = dr\,\hat{r} + r\,d\theta\,\hat{\theta} + r\sin\theta\,d\phi\,\hat{\phi}$$

$$= -\int_\infty^r E\,dr$$ since $\vec{E} = E(r)\,\hat{r}$ which eliminates the last two terms in $d\vec{l}$ by orthogonality.

for $r < a$

$$V(r) = -\int_\infty^r E\,dr$$
$$= -\int_\infty^b \frac{k}{\varepsilon_0}(b-a)\,r'^{-2}\,dr'$$
$$-\int_b^a \frac{k}{\varepsilon_0}\left(r'^{-1} - a\,r'^{-2}\right)dr'$$
$$-\int_a^r 0\,dr'$$

$$= +\frac{k}{\varepsilon_0}(b-a)\left(\frac{r'^{-1}}{+1}\right)\Big|_\infty^b$$
$$-\frac{k}{\varepsilon_0}\left[\ln r' + \frac{a\,r'^{-1}}{(+1)}\right]_b^a$$
$$+0$$
$$= \frac{k}{\varepsilon_0}\left[(b-a)\left(\frac{1}{b} - \cancelto{0}{\frac{1}{\infty}}\right) - \left(\ln a + \frac{a}{a}\right) + \left(\ln b + \frac{a}{b}\right)\right]$$

$$V(r) = \frac{k}{\varepsilon_0}\left[(b-a)\frac{1}{b} + \ln\left(\frac{b}{a}\right) - 1 + \frac{a}{b}\right]$$

$$= \frac{k}{\varepsilon_0}\left[\cancel{1} - \cancel{\frac{a}{b}} + \ln\left(\frac{b}{a}\right) - \cancel{1} + \cancel{\frac{a}{b}}\right]$$

$$\boxed{V(r) = \frac{k}{\varepsilon_0}\ln\left(\frac{b}{a}\right)}$$